US008405919B2

(12) **United States Patent**
Tsai et al.

(10) **Patent No.: US 8,405,919 B2**
(45) **Date of Patent: Mar. 26, 2013**

(54) **OPTICAL IMAGE LENS ASSEMBLY**

(75) Inventors: **Tsung-Han Tsai**, Taichung (TW); **Ming-Ta Chou**, Taichung (TW)

(73) Assignee: **Largan Precision Co., Ltd.**, Taichung (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **13/305,752**

(22) Filed: **Nov. 29, 2011**

(65) **Prior Publication Data**

US 2012/0327521 A1 Dec. 27, 2012

(30) **Foreign Application Priority Data**

Jun. 22, 2011 (TW) 100121847

(51) **Int. Cl.**
G02B 3/02 (2006.01)
G02B 9/08 (2006.01)
G02B 9/34 (2006.01)

(52) **U.S. Cl.** **359/715**; 359/738; 359/740; 359/771; 359/772; 359/773; 359/774; 359/775

(58) **Field of Classification Search** 359/715, 359/738–740, 771–775
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,085,077	B1	8/2006	Noda	
7,365,920	B2	4/2008	Noda	
7,777,972	B1 *	8/2010	Chen et al.	359/773
2007/0188891	A1 *	8/2007	Shinohara	359/774
2009/0009889	A1 *	1/2009	Teraoka et al.	359/773
2010/0060996	A1 *	3/2010	Ozaki	359/715
2010/0103533	A1 *	4/2010	Taniyama	359/715
2010/0309367	A1 *	12/2010	Iba et al.	359/715
2011/0075271	A1 *	3/2011	Tang et al.	359/715
2011/0115962	A1 *	5/2011	Chen et al.	359/715

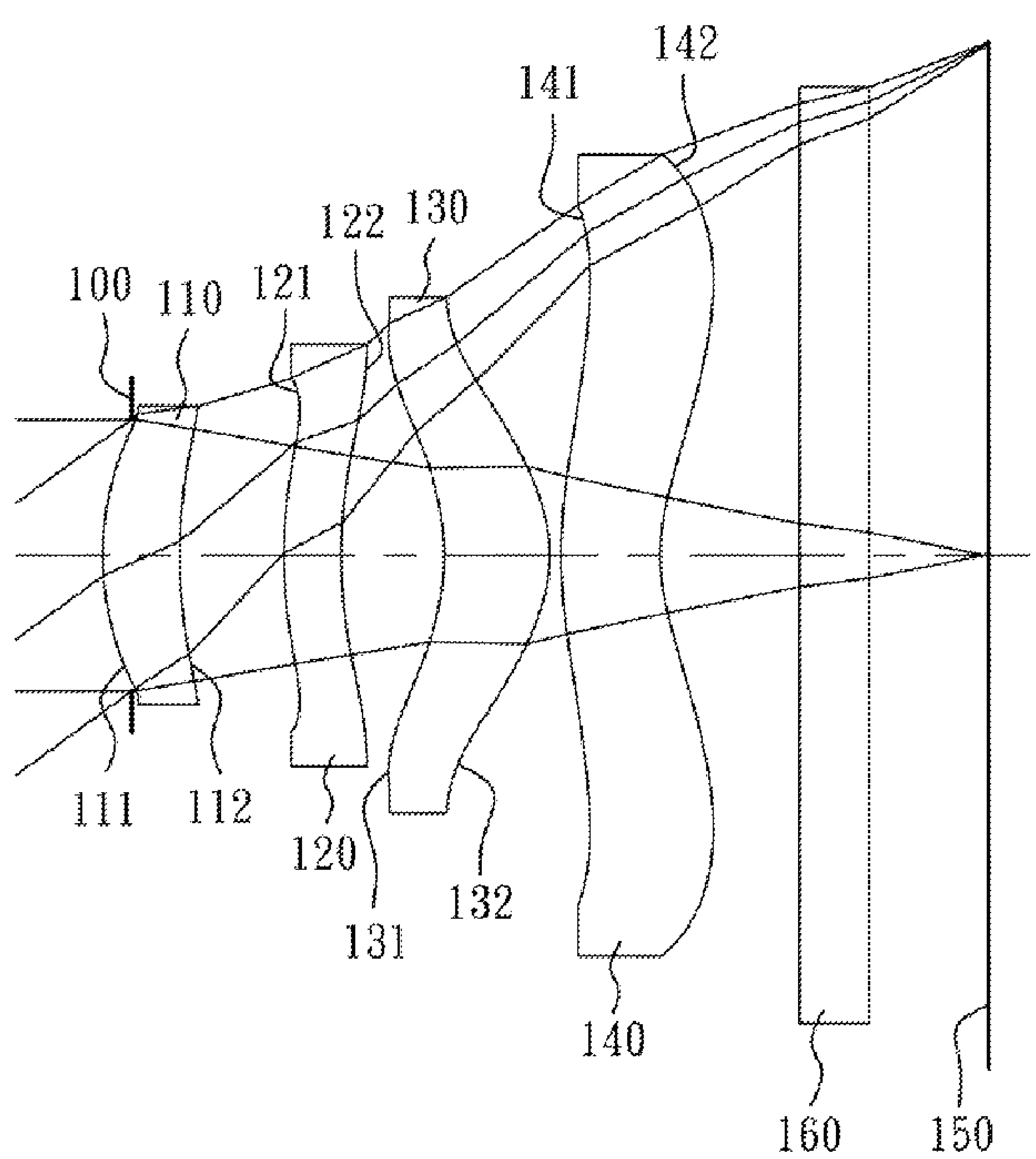
* cited by examiner

Primary Examiner — Evelyn A. Lester
(74) *Attorney, Agent, or Firm* — CKC & Partners Co., Ltd.

(57) **ABSTRACT**

An optical image lens assembly includes, in order from an object side to an image side, a first lens element, a second lens element, a third lens element and a fourth lens element. The first lens element with positive refractive power has a convex object-side surface. The second lens element has refractive power. The third lens element with refractive power is made of plastic material, wherein an object-side surface and an image-side surface of the third lens element are aspheric. The fourth lens element with negative refractive power is made of plastic material, and has a concave image-side surface, wherein an object-side surface and the image-side surface of the fourth lens element are aspheric, and the fourth lens element has at least one inflection point formed on at least one of the object-side surface and the image-side surface thereof.

22 Claims, 12 Drawing Sheets



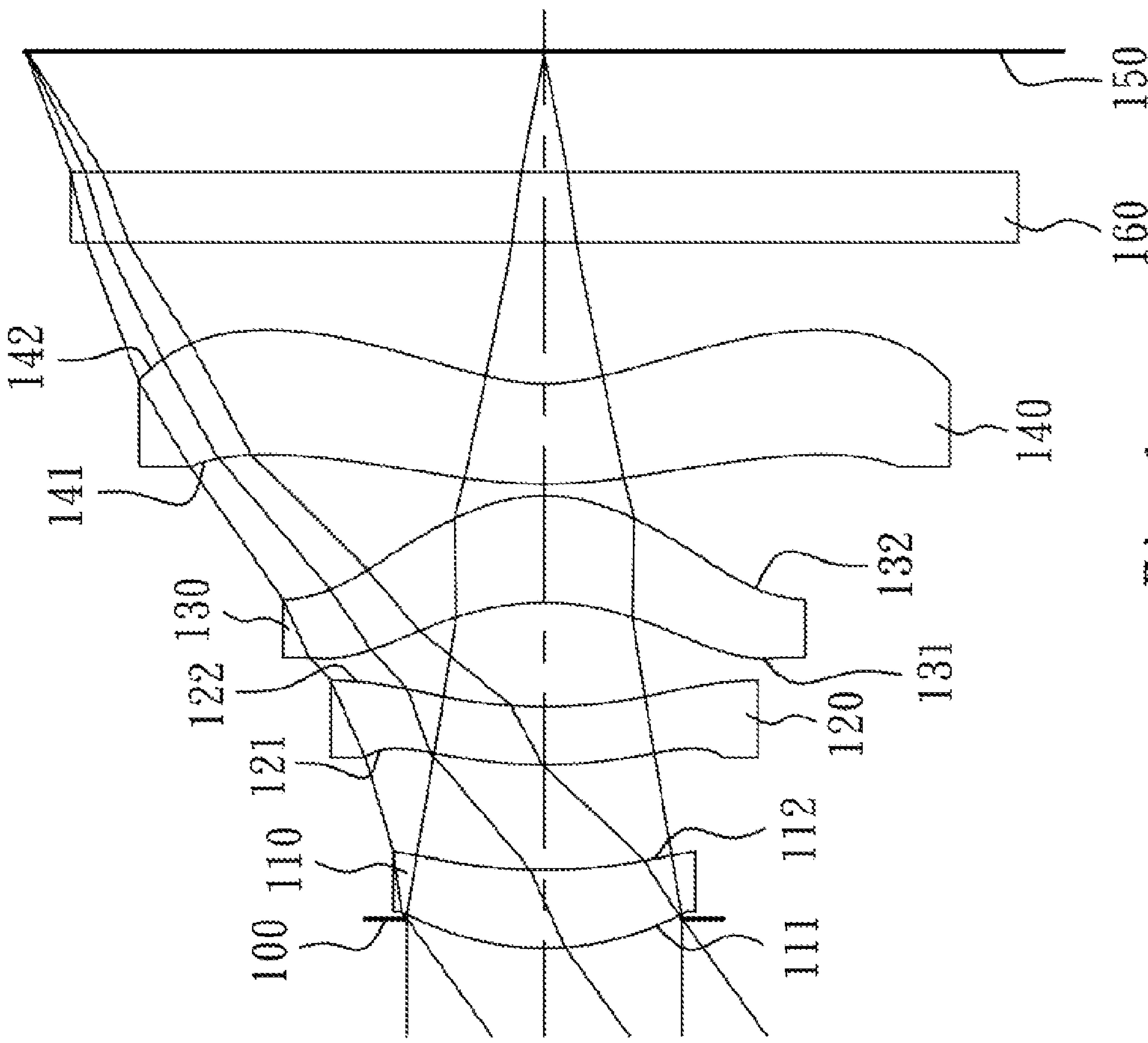


Fig. 1

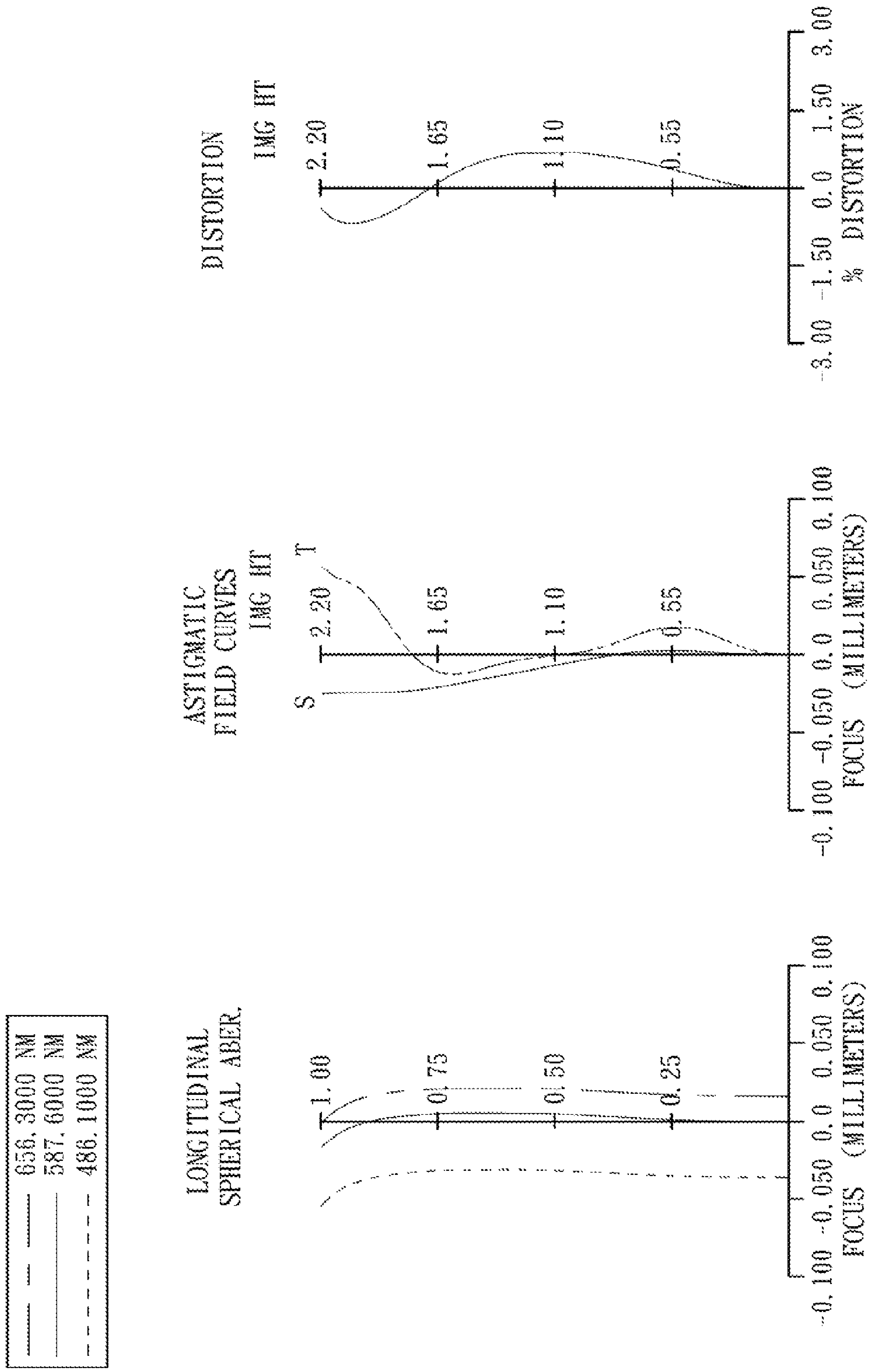

656.3000 NM
587.6000 NM
486.1000 NM
LONGITUDINAL SPHERICAL ABER.
1.00
0.75
0.50
0.25
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
ASTIGMATIC FIELD CURVES
IMG HT
T
S
2.20
1.65
1.10
0.55
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
DISTORTION
IMG HT
2.20
1.65
1.10
0.55
-3.00 -1.50 0.0 1.50 3.00
% DISTORTION

Fig. 2

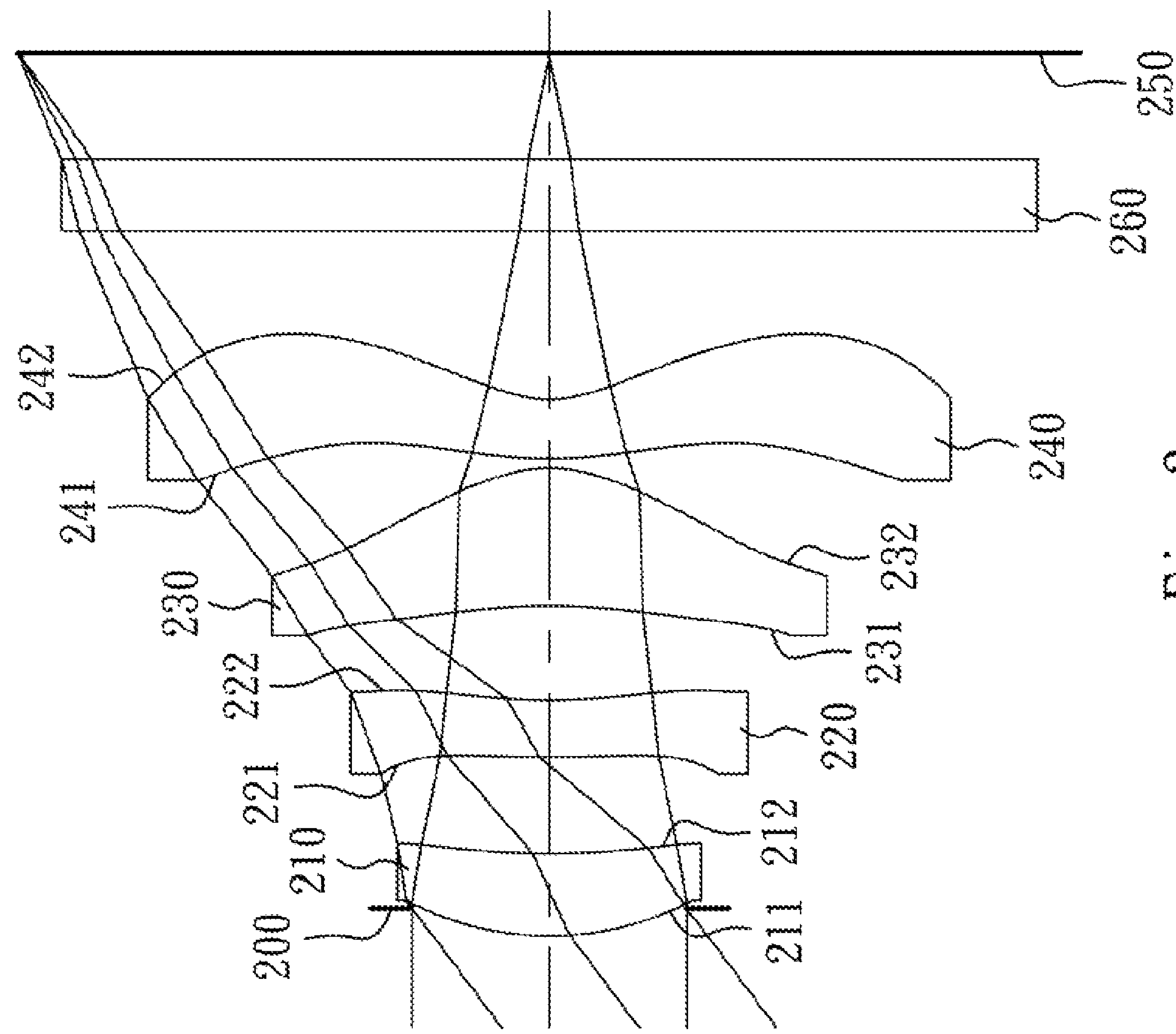


Fig. 3

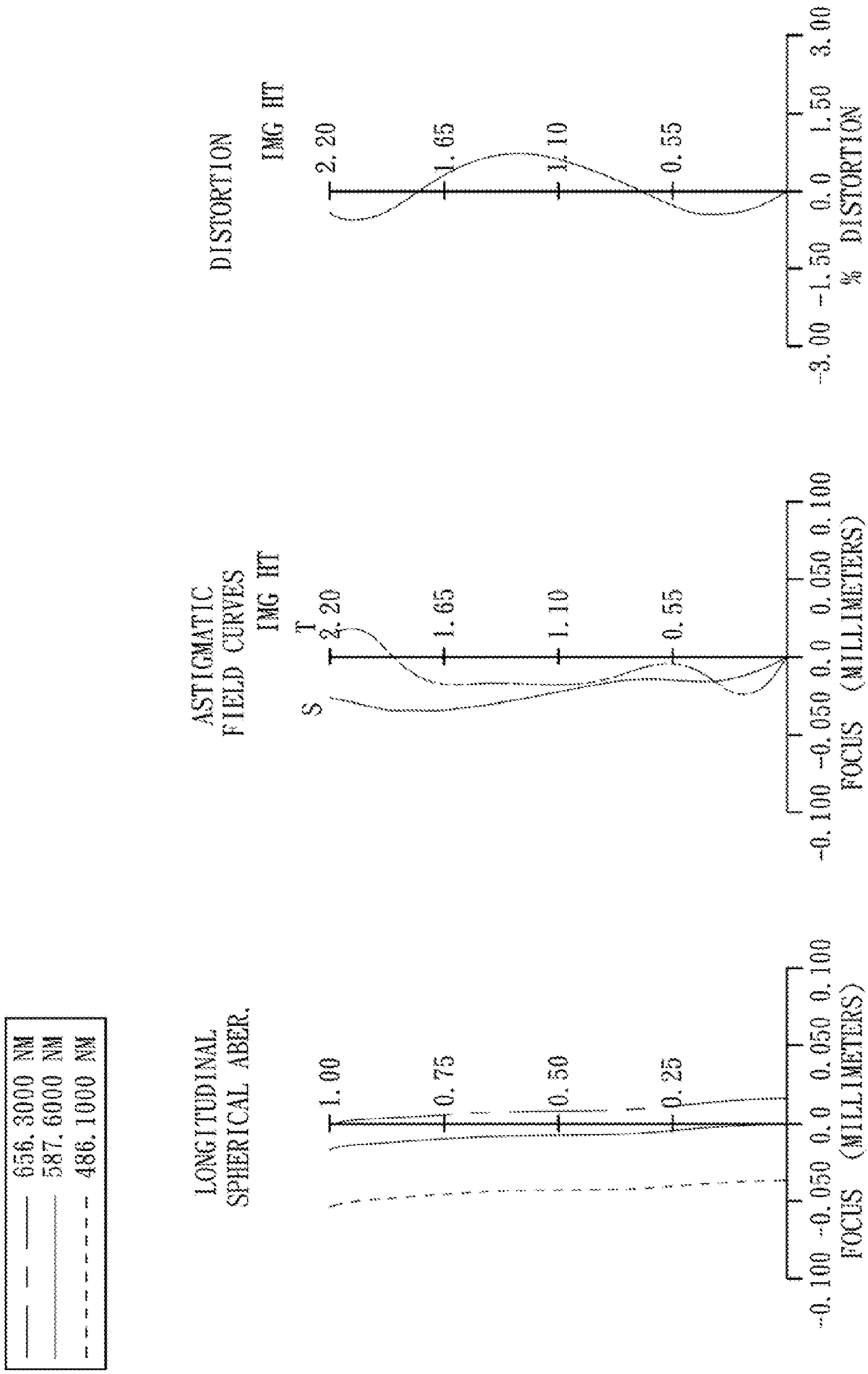

656.3000 NM
587.6000 NM
486.1000 NM
LONGITUDINAL SPHERICAL ABER.
1.00
0.75
0.50
0.25
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
ASTIGMATIC FIELD CURVES
IMG HT
T
S
2.20
1.65
1.10
0.55
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
DISTORTION
IMG HT
2.20
1.65
1.10
0.55
-3.00 -1.50 0.0 1.50 3.00
% DISTORTION

Fig. 4

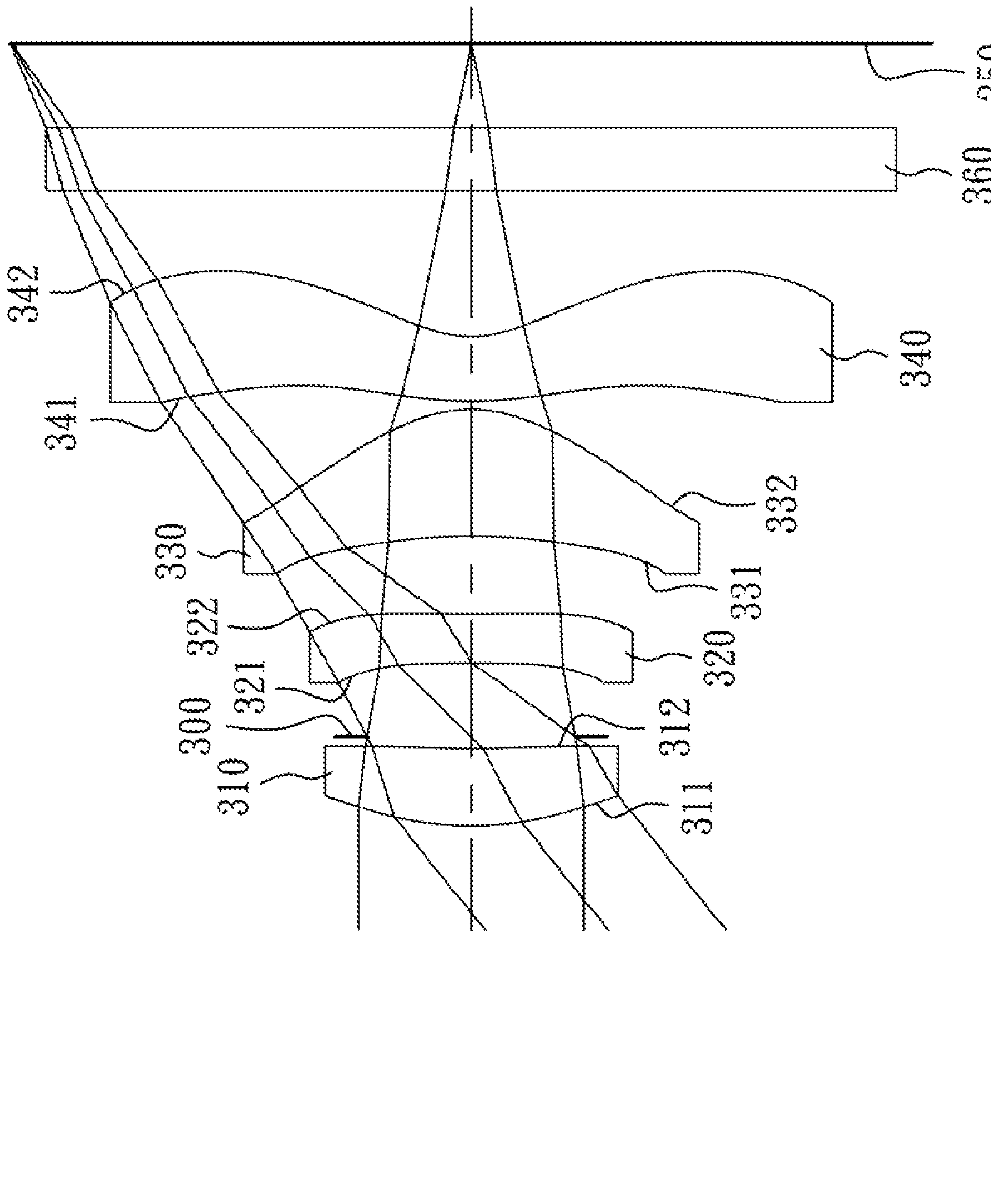


Fig. 5

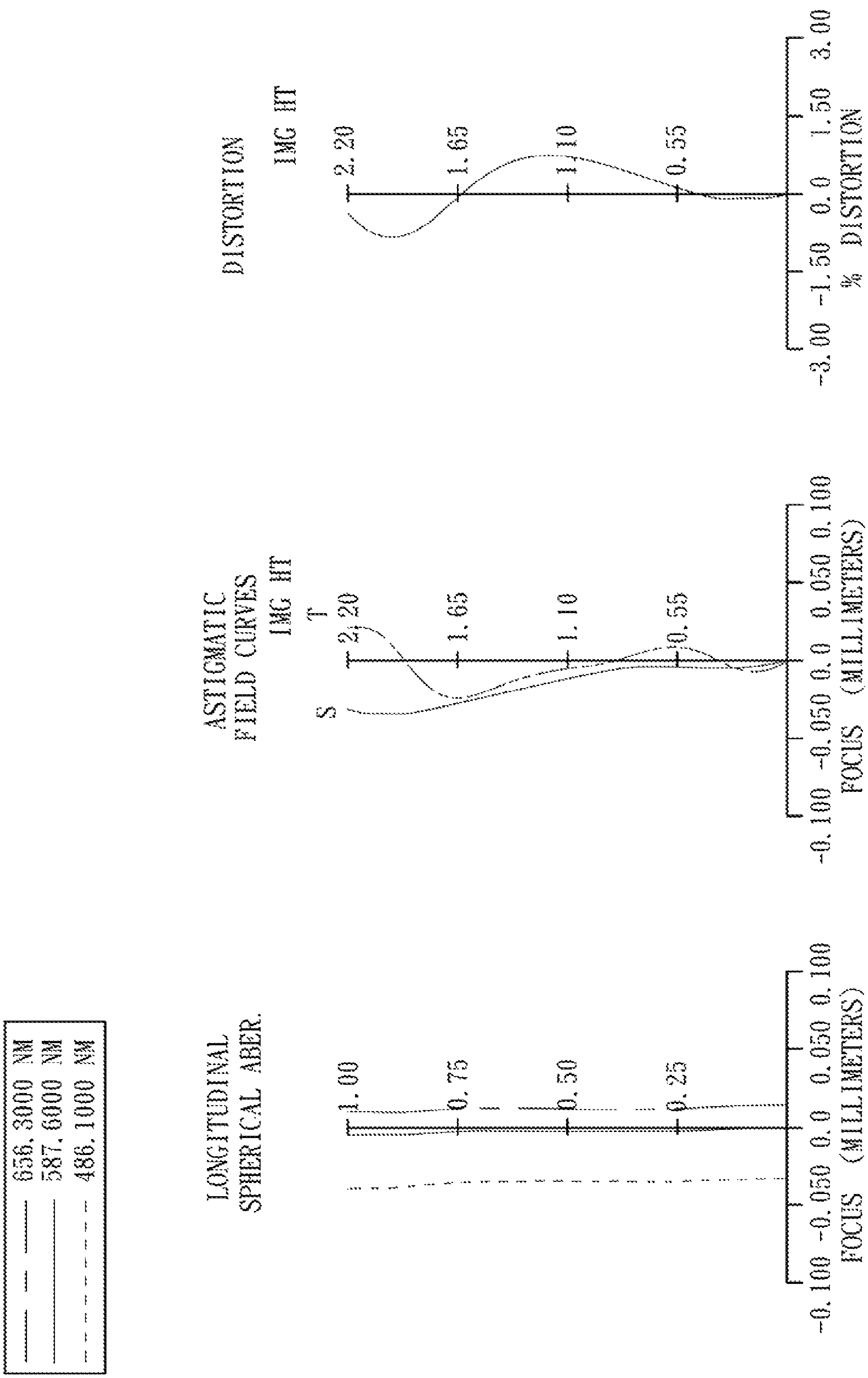

656.3000 NM
587.6000 NM
486.1000 NM
LONGITUDINAL SPHERICAL ABER.
1.00
0.75
0.50
0.25
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
ASTIGMATIC FIELD CURVES
IMG HT
T
S
2.20
1.65
1.10
0.55
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
DISTORTION
IMG HT
2.20
1.65
1.10
0.55
-3.00 -1.50 0.0 1.50 3.00
% DISTORTION

Fig. 6

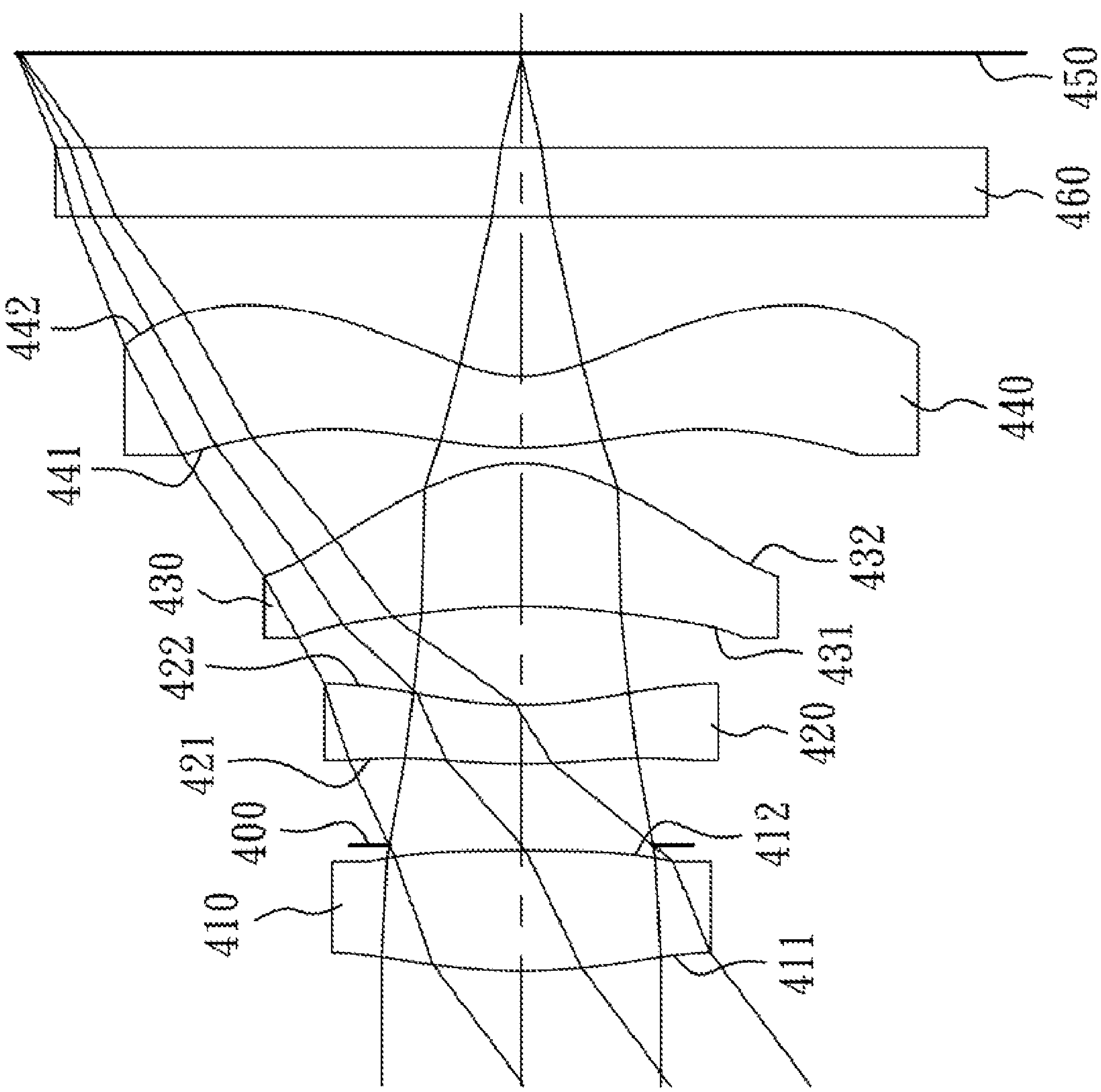


Fig. 7

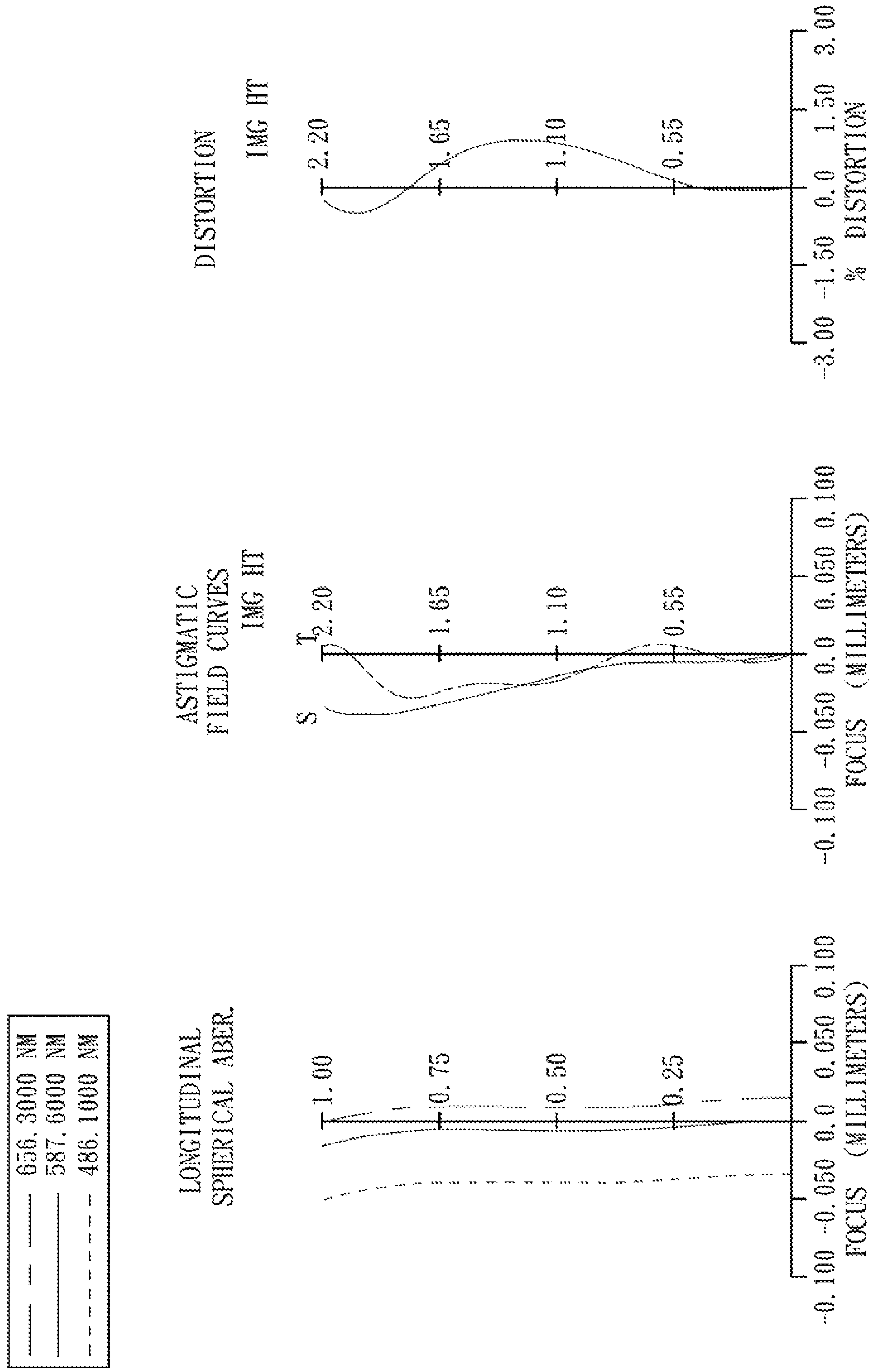

656.3000 NM
587.6000 NM
486.1000 NM
LONGITUDINAL
SPHERICAL ABER.
1.00
0.75
0.50
0.25
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
ASTIGMATIC
FIELD CURVES
IMG HT
2.20
1.65
1.10
0.55
T
S
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
DISTORTION
IMG HT
2.20
1.65
1.10
0.55
-3.00 -1.50 0.0 1.50 3.00
% DISTORTION

Fig. 8

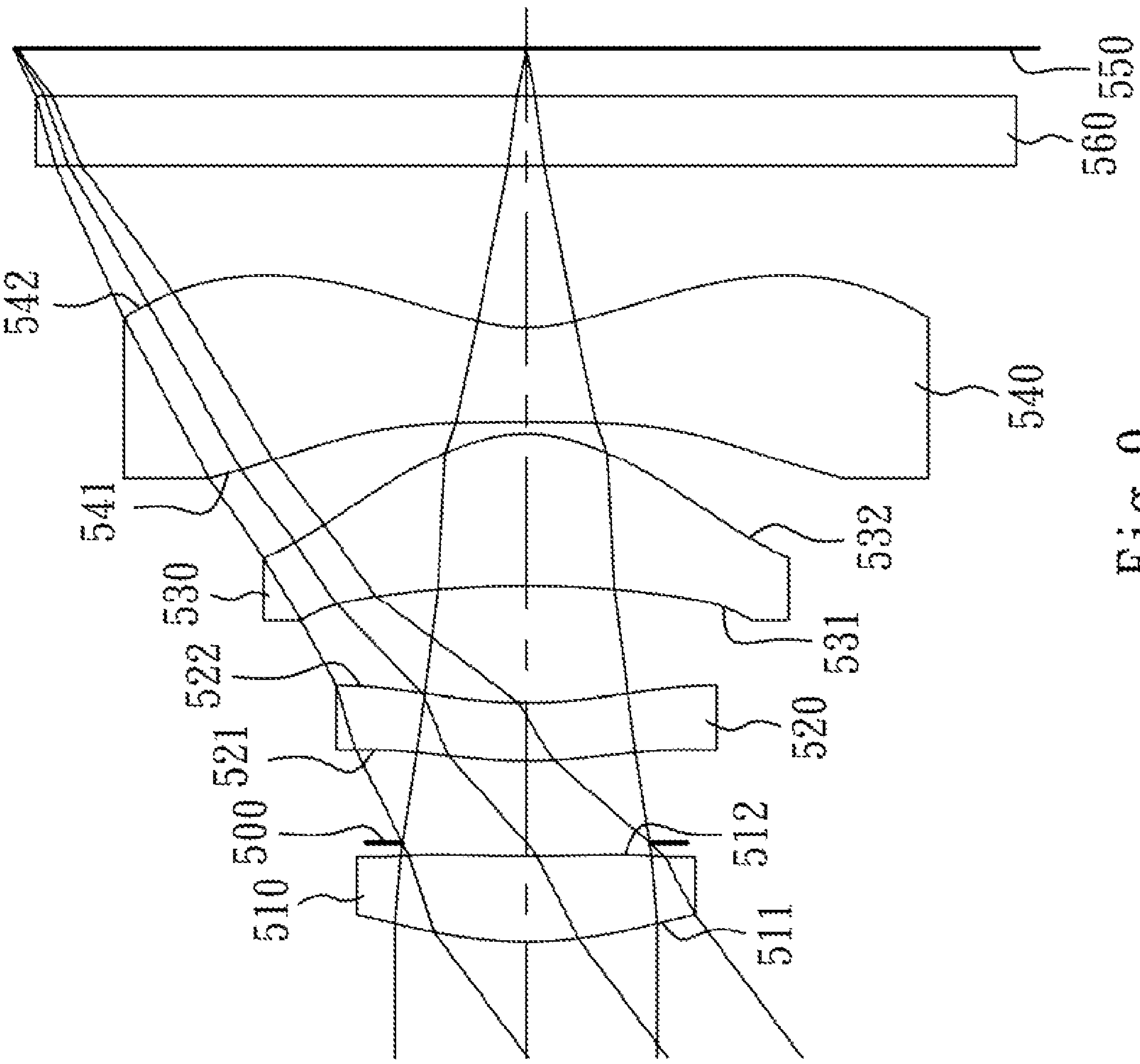


Fig. 9

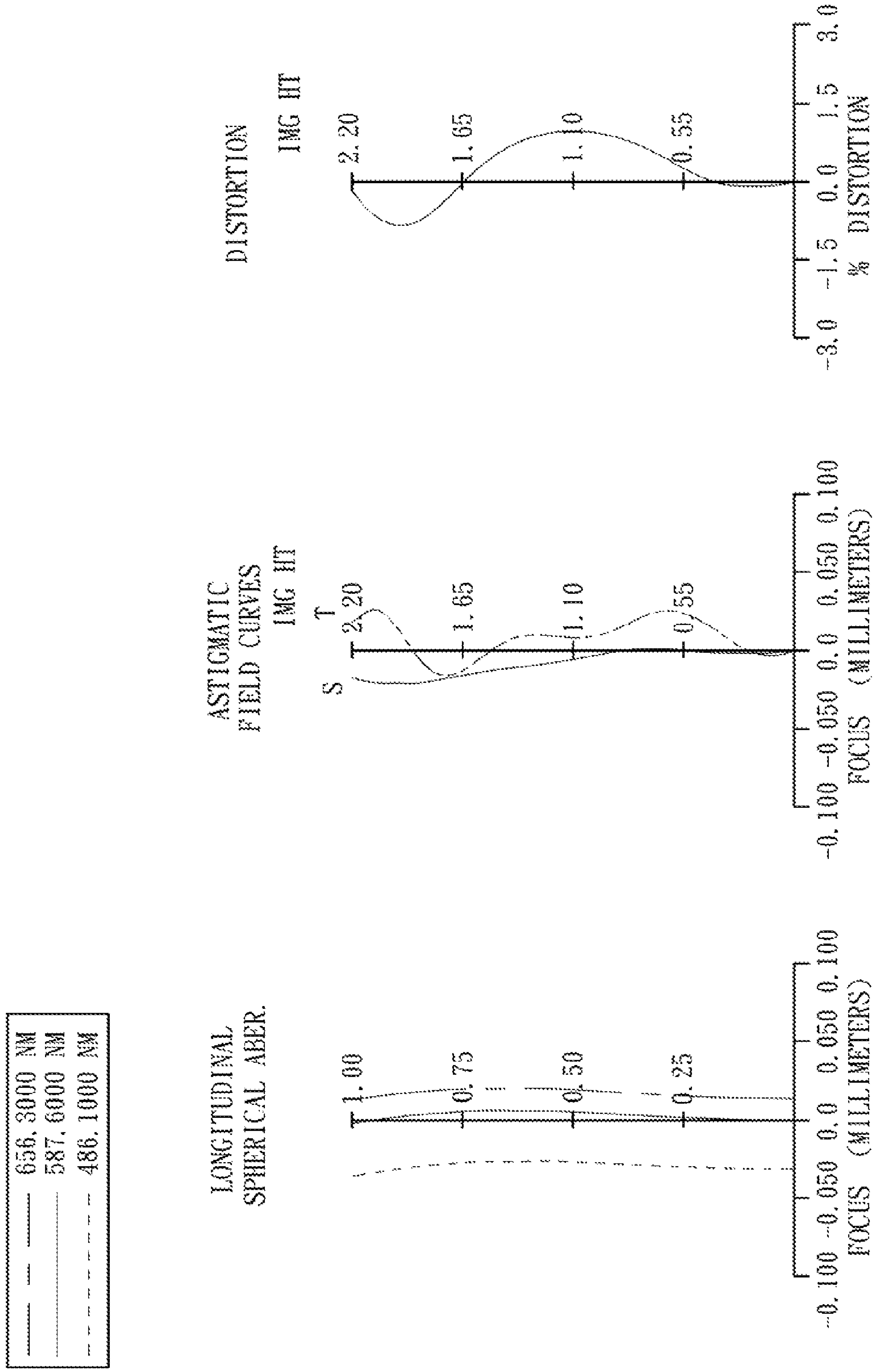

656.3000 NM
587.6000 NM
486.1000 NM
LONGITUDINAL
SPHERICAL ABER.
1.00
0.75
0.50
0.25
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
ASTIGMATIC
FIELD CURVES
IMG HT
T
S
2.20
1.65
1.10
0.55
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
DISTORTION
IMG HT
2.20
1.65
1.10
0.55
-3.0 -1.5 0.0 1.5 3.0
% DISTORTION

Fig. 10

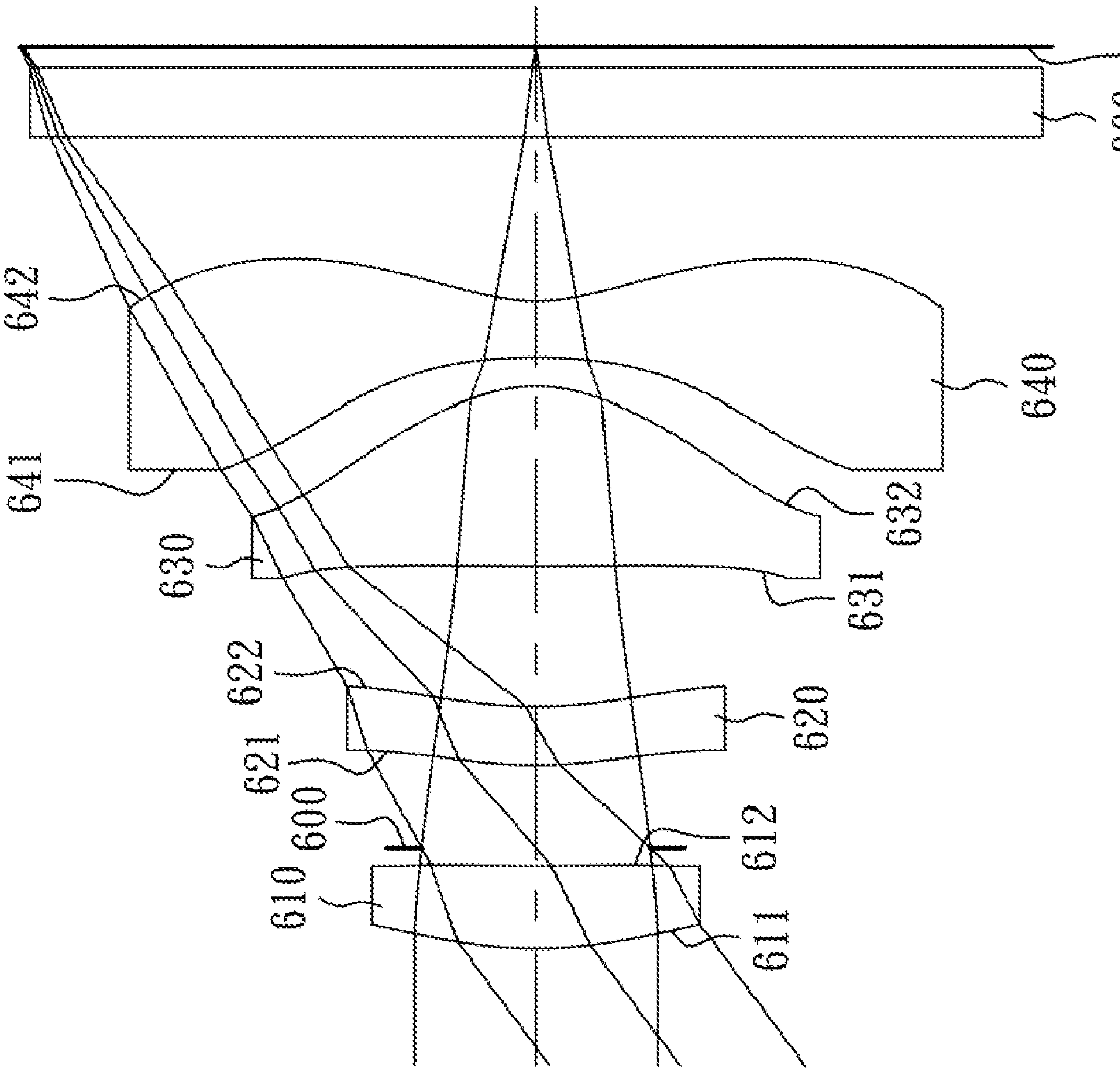


Fig. 11

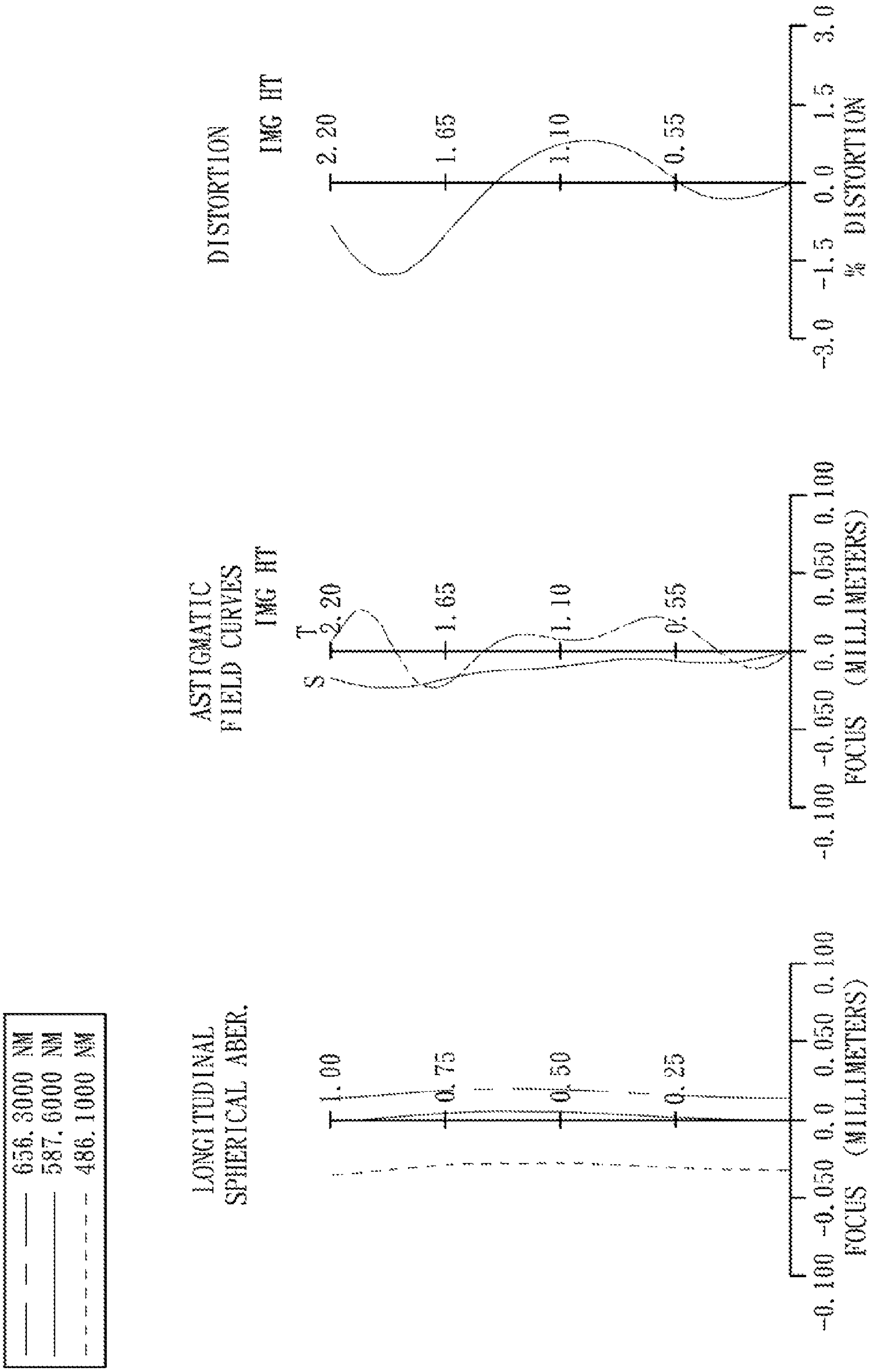

656.3000 NM
587.6000 NM
486.1000 NM
LONGITUDINAL
SPHERICAL ABER.
1.00
0.75
0.50
0.25
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
ASTIGMATIC
FIELD CURVES
IMG HT
T
S
2.20
1.65
1.10
0.55
-0.100 -0.050 0.0 0.050 0.100
FOCUS (MILLIMETERS)
DISTORTION
IMG HT
2.20
1.65
1.10
0.55
-3.0 -1.5 0.0 1.5 3.0
% DISTORTION

Fig. 12

OPTICAL IMAGE LENS ASSEMBLY

RELATED APPLICATIONS

The application claims priority to Taiwan Application Serial Number 100121847, filed Jun. 22, 2011, which is herein incorporated by reference.

BACKGROUND

1. Technical Field

The present disclosure relates to an optical image lens assembly. More particularly, the present disclosure relates to a compact optical image lens assembly applicable to electronic products.

2. Description of Related Art

In recent years, with the popularity of mobile products with camera functionalities, the demand for a compact optical image lens assembly is increasing. The sensor of a conventional photographing camera is typically a CCD (Charge Coupled Device) or a CMOS (Complementary Metal-Oxide Semiconductor Sensor). As advanced semiconductor manufacturing technologies have allowed the pixel size of sensors to be reduced and compact optical image lens assemblies have gradually evolved toward the fields of higher megapixels, there is an increasing demand for compact optical image lens assemblies featuring better image quality.

A conventional compact optical image lens assembly in a portable electronic product typically utilizes a three-element lens structure. Such a conventional optical image lens assembly has a first lens element with positive refractive power, a second lens element with negative refractive power and a third lens element with positive refractive power. The first, second and third lens elements are arranged in this order from an object-side to an image-side. While the three-element lens structure is compact, it is not able to produce high resolution images.

Further, another conventional compact optical image lens assembly provides a four-element lens structure. The first lens element and the second lens element of the four-element lens structure are two glass spherical lens elements which are attached to each other to form a doublet lens for eliminating chromatic aberration. However, this lens structure requires a longer total optical track length caused by insufficient degrees of freedom in setting system parameters due to too many spherical lenses allocated. Moreover, it is not easy to attach the glass lenses, and thus the manufacturing process for forming the glass doublet lenses is difficult. Therefore, a need exists in the art for providing an optical image lens assembly for use in a mobile electronic product that has excellent imaging quality with a desirable total track length.

SUMMARY

According to one aspect of the present disclosure, an optical image lens assembly includes, in order from an object side to an image side, a first lens element, a second lens element, a third lens element and a fourth lens element. The first lens element with positive refractive power has a convex object-side surface. The second lens element has refractive power. The third lens element with refractive power is made of plastic material, wherein an object-side surface and an image-side surface of the third lens element are aspheric. The fourth lens element with negative refractive power is made of plastic material, and has a concave image-side surface, wherein an object-side surface and the image-side surface of the fourth lens element are aspheric, and the fourth lens element has at least one inflection point formed on at least one of the object-side surface and the image-side surface thereof. The Abbe number of the first lens element is V1, the Abbe number of the second lens element is V2, the Abbe number of the third lens element is V3, the Abbe number of the fourth lens element is V4, a focal length of the optical image lens assembly is f, the focal length of the first lens element is f1, and the following relationships are satisfied:

$$0.8<V1/V2<1.3;$$

$$0.8<V2/V3<1.3;$$

$$0.8<V3/V4<1.3; \text{ and}$$

$$0<f/f1<1.2.$$

According to another aspect of the present disclosure, an optical image lens assembly includes, in order from an object side to an image side, a first lens element, a second lens element, a third lens element and a fourth lens element. The first lens element with positive refractive power has a convex object-side surface. The second lens element has refractive power. The third lens element with refractive power is made of plastic material, wherein an object-side surface and an image-side surface of the third lens element are aspheric. The fourth lens element with negative refractive power is made of plastic material, and has a concave image-side surface, wherein an object-side surface and the image-side surface of the fourth lens element are aspheric, and the fourth lens element has at least one inflection point formed on at least one of the object-side surface and the image-side surface thereof. The Abbe number of the first lens element is V1, the Abbe number of the second lens element is V2, the Abbe number of the third lens element is V3, the Abbe number of the fourth lens element is V4, an axial distance between the first lens element and the second lens element is T12, a central thickness of the second lens element is CT2, and the following relationships are satisfied:

$$0.8<V1/V2<1.3;$$

$$0.8<V2/V3<1.3;$$

$$0.8<V3/V4<1.3; \text{ and}$$

$$0.4<T12/CT2<2.5.$$

According to yet another aspect of the present disclosure, an optical image lens assembly includes, in order from an object side to an image side, a first lens element, a second lens element, a third lens element and a fourth lens element. The first lens element with positive refractive power has a convex object-side surface and a concave image-side surface. The second lens element has refractive power. The third lens element with refractive power is made of plastic material, wherein an object-side surface and an image-side surface of the third lens element are aspheric. The fourth lens element with negative refractive power is made of plastic material, and has a concave image-side surface, wherein an object-side surface and the image-side surface of the fourth lens element are aspheric, and the fourth lens element has at least one inflection point formed on at least one of the object-side surface and the image-side surface thereof. The Abbe number of the first lens element is V1, the Abbe number of the second lens element is V2, the Abbe number of the third lens element is V3, the Abbe number of the fourth lens element is V4, and the following relationships are satisfied:

$$0.8<V1/V2<1.3;$$

$$0.8<V2/V3<1.3; \text{ and}$$

$$0.8<V3/V4<1.3.$$

According to yet another aspect of the present disclosure, an optical image lens assembly includes, in order from an object side to an image side, a first lens element, a second lend element, a third lens element and a fourth lens element. The first lens element with positive refractive power has a convex object-side surface. The second lend element has refractive power. The third lens element with refractive power is made of plastic material, wherein an object-side surface and an image-side surface of the third lens element are aspheric. The fourth lens element with refractive power is made of plastic material, and has a concave image-side surface, wherein an object-side surface and the image-side surface of the fourth lens element are aspheric, and the fourth lens element has at least one inflection point formed on at least one of the object-side surface and the image-side surface thereof. The Abbe number of the first lens element is V1, the Abbe number of the second lens element is V2, the Abbe number of the third lens element is V3, the Abbe number of the fourth lens element is V4, a focal length of the optical image lens assembly is f, a focal length of the third lens element is f3, and the following relationships are satisfied:

$$0.8<V1/V2<1.3;$$

$$200<V1+V2+V3+V4<250; \text{ and}$$

$$0.50<f/f3<3.00.$$

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic view of an optical image lens assembly according to the first embodiment of the present disclosure;

FIG. **2** shows spherical aberration curves, astigmatic field curves and a distortion curve of the optical image lens assembly according to the first embodiment;

FIG. **3** is a schematic view of an optical image lens assembly according to the second embodiment of the present disclosure;

FIG. **4** shows spherical aberration curves, astigmatic field curves and a distortion curve of the optical image lens assembly according to the second embodiment;

FIG. **5** is a schematic view of an optical image lens assembly according to the third embodiment of the present disclosure;

FIG. **6** shows spherical aberration curves, astigmatic field curves and a distortion curve of the optical image lens assembly according to the third embodiment;

FIG. **7** is a schematic view of an optical image lens assembly according to the fourth embodiment of the present disclosure;

FIG. **8** shows spherical aberration curves, astigmatic field curves and a distortion curve of the optical image lens assembly according to the fourth embodiment;

FIG. **9** is a schematic view of an optical image lens assembly according to the fifth embodiment of the present disclosure;

FIG. **10** shows spherical aberration curves, astigmatic field curves and a distortion curve of the optical image lens assembly according to the fifth embodiment;

FIG. **11** is a schematic view of an optical image lens assembly according to the sixth embodiment of the present disclosure; and

FIG. **12** shows spherical aberration curves, astigmatic field curves and a distortion curve of the optical image lens assembly according to the sixth embodiment.

DETAILED DESCRIPTION

An optical image lens assembly includes, in order from an object side to an image side, a first lens element, a second lens element, a third lens element and a fourth lens element. The optical image lens assembly further includes an image sensor located on an image plane.

The first lens element with positive refractive power provides partial refractive power for reducing the total track length of the optical image lens assembly. The first lens element can have a convex object-side surface and a convex image-side surface, or a convex object-side surface and a concave image-side surface. When the first lens element has a convex object-side surface and a convex image-side surface, the refractive power of the first lens element can be enhanced for reducing the total track length of the optical image lens assembly. When the first lens element has a convex object-side surface and a concave image-side surface, the astigmatism of the optical image lens assembly can be corrected.

The second lens element can have negative refractive power, so that the aberration generated from the first lens element with positive refractive power can be corrected.

The third lens element with positive refractive power can reduce the photosensitivity by providing a partial distribution of the refractive power of the optical image lens assembly. The third lens element can have a concave object-side surface and a convex image-side surface. Therefore, the astigmatism of the optical image lens assembly can be corrected.

The fourth lens element with negative refractive power has a concave iii image-side surface, so that the principal point of the optical image lens assembly can be positioned away from the image plane, and the total track length of the optical image lens assembly can be reduced so as to maintain the compact size of the optical image lens assembly. Furthermore, the fourth lens element has at least one inflection point formed on at least one surface thereof. Therefore, the incident angle of the off-axis field of light on the image sensor can be effectively minimized and the aberration of the off-axis field can be corrected.

When the Abbe number of the first lens element is V1, the Abbe number of the second lens element is V2, the Abbe number of the third lens element is V3, and the Abbe number of the fourth lens element is V4, the following relationships are satisfied:

$$0.8<V1/V2<1.3;$$

$$0.8<V2/V3<1.3;$$

$$0.8<V3/V4<1.3; \text{ and}$$

$$V2>50.$$

Therefore, when each lens element of the optical image lens assembly has proper Abbe number at the specific range, the generation of the chromatic dispersion of the optical image lens assembly can be minimized.

When a focal length of the optical image lens assembly is f, and a focal length of the first lens element is f1, the following relationship is satisfied:

$$0<f/f1<1.2.$$

Therefore, the total track length of the optical image lens assembly can be controlled and the generation of the spherical aberration of the optical image lens assembly can be minimized by the balanced refractive power of the first lens element.

When the focal length of the optical image lens assembly is f, and a focal length of the second lens element is f2, the following relationship is satisfied:

$$|f/f2|<0.5.$$

Therefore, the refractive power of the second lens element can correct the aberration generated from the first lens element effectively.

When a maximum image height of the optical image lens assembly is ImgH, which here is half of the diagonal length of a photosensitive area of the image sensor, and an axial distance between the object-side surface of the first lens element and the image plane is TTL, the following relationship is satisfied:

$$TTL/\mathrm{Img}H<2.0.$$

Therefore, the total track length of the optical image lens assembly can be reduced, so as to maintain the compact size of the optical image lens assembly. As a result, the optical image lens assembly may be employed in lightweight and portable electronic products.

When an axial distance between the first lens element and the second lens element is T12, and a central thickness of the second lens element is CT2, the following relationship is satisfied:

$$0.4<T12/CT2<2.5.$$

Therefore, the thickness of the second lens element and the axial distance between the first lens element and the second lens element can further reduce the total track length of the optical image lens assembly.

T12 and CT2 can further satisfy the following relationship:

$$1.2<T12/CT2<2.5.$$

When the Abbe number of the first lens element is V1, the Abbe number of the second lens element is V2, the Abbe number of the third lens element is V3, and the Abbe number of the fourth lens element is V4, the following relationship is satisfied:

$$200<V1+V2+V3+V4<250.$$

Therefore, the chromatic dispersion of the optical image lens assembly can be corrected.

When the focal length of the optical image lens assembly is f, and a focal length of the third lens element is f3, the following relationship is satisfied:

$$0.50<f/f3<3.00.$$

Therefore, the third lens element can reduce the photosensitivity by providing a partial distribution of the refractive power of the optical image lens assembly.

f and f3 can further satisfy the following relationship:

$$1.00<f/f3<3.00.$$

According to the optical image lens assembly of the present disclosure, when the lens element has a convex surface, it indicates that the paraxial region of the surface is convex; and when the lens element has a concave surface, it indicates that the paraxial region of the surface is concave.

According to the optical image lens assembly of the present disclosure, the lens elements thereof can be made of plastic material or glass. When the lens elements are made of plastic material, the cost of manufacture can be effectively reduced. The lens elements also can be made of glass material, so that the range of the refractive power of the optical image lens assembly that can be set may be increased. Furthermore, the surface of each lens element can be aspheric, so that it is easier to make the surface into other non-spherical shapes. As a result, more controllable variables are obtained, and the aberration is reduced, and the number of required lens elements is reduced. Therefore, the total track length of the optical image lens assembly can be reduced.

According to the optical image lens assembly of the present disclosure, the image capturing lens assembly can include at least one stop for reducing stray light while retaining high image quality or other functionalities. Furthermore, when the stop is an aperture stop, the position of the aperture stop within an optical system can be arbitrarily placed in front of the entire optical system or within the optical system in accordance with the preference of the designer of the optical system, in order to achieve the desirable optical features or higher image quality produced from the optical system.

According to the above description of the present disclosure, the following 1st-6th specific embodiments are provided for further explanation.

FIG. **1** is a schematic view of an optical image lens assembly according to the first embodiment of the present disclosure. FIG. **2** shows spherical aberration curves, astigmatic field curves and a distortion curve of the optical image lens assembly according to the first embodiment. In FIG. **1**, the optical image lens assembly includes, in order from an object side to an image side, an aperture stop **100**, the first lens element **110**, the second lens element **120**, the third lens element **130**, the fourth lens element **140**, an IR (infrared) cut filter **160** and an image plane **150**.

The first lens element **110** is made of plastic material. The first lens element **110** with positive refractive power has a convex object-side surface **111** and a concave image-side surface **112**. The object-side surface **111** and the image-side surface **112** of the first lens element **110** are aspheric.

The second lens element **120** is made of plastic material. The second lens element **120** with positive refractive power has a convex object-side surface **121** and a concave image-side surface **122**. The object-side surface **121** and the image-side surface **122** of the second lens element **120** are aspheric.

The third lens element **130** is made of plastic material. The third lens element **130** with positive refractive power has a concave object-side surface **131** and a convex image-side surface **132**. The object-side surface **131** and the image-side surface **132** of the third lens element **130** are aspheric.

The fourth lens element **140** is made of plastic material. The fourth lens element **140** with negative refractive has a convex object-side surface **141** and a concave image-side surface **142**. The object-side surface **141** and the image-side surface **142** of the fourth lens element **140** are aspheric. The fourth lens element **140** has inflection points formed on the object-side surface **141** and the image-side surface **142** thereof.

The IR cut filter **160** is made of glass and located between the fourth lens element **140** and the image plane **150**, and will not affect the focal length of the optical image lens assembly.

The equation of the aspheric surface profiles of the aforementioned lens elements of the first embodiment is expressed as follows:

$$X(Y)=(Y^2/R)/(1+sqrt(1-(1+k)\times(Y/R)^2))+\sum_i (Ai)\times(Y^i)$$

where:

X is the height of a point on the aspheric surface spaced at a distance Y from the optical axis relative to the tangential plane at the aspheric surface vertex;

Y is the distance from the point on the curve of the aspheric surface to the optical axis;

R is the curvature radius of the lens elements;

k is the conic coefficient; and

Ai is the i-th aspheric coefficient.

In the optical image lens assembly according to the first embodiment, when a focal length of the optical image lens assembly is f, an f-number of the optical image lens assembly is Fno, and a half of the maximal field of view is HFOV, these parameters have the following values:

f=3.04 mm;

Fno=2.60; and

HFOV=36.0 degrees.

In the optical image lens assembly according to the first embodiment, when the Abbe number of the first lens element **110** is V1, the Abbe number of the second lens element **120** is V2, the Abbe number of the third lens element **130** is V3, and the Abbe number of the fourth lens element **140** is V4, the following relationships are satisfied:

$$V2=55.9;$$

$$V1/V2=1.00;$$

$$V2/V3=1.00;$$

$$V3/V4=1.00; \text{ and}$$

$$V1+V2+V3+V4=223.6.$$

In the optical image lens assembly according to the first embodiment, when an axial distance between the first lens element **110** and the second lens element **120** is T12, a central thickness of the second lens element **120** is CT2, the following relationship is satisfied:

$$T12/CT2=1.81.$$

In the optical image lens assembly according to the first embodiment, when the focal length of the optical image lens assembly is f, a focal length of the first lens element **110** is f1, a focal length of the second lens element **120** is f2, and a focal length of the third lens element **130** is f3, the following relationships are satisfied:

$$f/f1=0.68;$$

$$|f/f2|=0.15; \text{ and}$$

$$f/f3=1.22.$$

In the optical image lens assembly according to the first embodiment, the image sensor is located on an image plane **150**, when a maximum image height of the optical image lens assembly is ImgH, and an axial distance between the object-side surface **111** of the first lens element **110** and the image plane **150** is TTL, the following relationship is satisfied:

$$TTL/ImgH=1.69.$$

The detailed optical data of the first embodiment are shown in Table 1 and the aspheric surface data are shown in Table 2 below.

TABLE 1

1st Embodiment f = 3.04 mm, Fno = 2.60, HFOV = 36.0 deg.							
Surface #		Curvature Radius	Thickness	Material	Index	Abbe #	Focal length
0	Object	Plano	Infinity				
1	Ape. Stop	Plano	−0.125				
2	Lens 1	1.232820 (ASP)	0.335	Plastic	1.544	55.9	4.47
3		2.261970 (ASP)	0.445				
4	Lens 2	1.829500 (ASP)	0.246	Plastic	1.544	55.9	20.14
5		2.092130 (ASP)	0.446				
6	Lens 3	−1.042450 (ASP)	0.451	Plastic	1.544	55.9	2.50
7		−0.680440 (ASP)	0.050				
8	Lens 4	2.116560 (ASP)	0.426	Plastic	1.544	55.9	−2.93
9		0.845640 (ASP)	0.600				
10	IR-filter	Plano	0.300	Glass	1.516	64.1	—
11		Plano	0.515				
12	Image	Plano	—				

Note:
Reference wavelength (d-line) is 587.6 nm.

TABLE 2

Aspheric Coefficients				
	Surface #			
	2	3	4	5
k =	−4.10746E−01	−1.83483E+00	−8.73801E−01	2.11882E−02
A4 =	1.62539E−02	−2.30948E−02	−1.04820E−01	−5.89221E−03
A6 =	−4.47049E−02	−9.88364E−02	−2.48981E−01	−1.82667E−01
A8 =	2.57125E−01	9.08390E−02	−2.39736E−01	−6.99122E−02

TABLE 2-continued

Aspheric Coefficients				
A10 =	−8.40867E−01	−3.81565E−01	1.07657E−01	2.44723E−02
A12 =	6.74930E−01	−1.66666E−01	5.22231E−01	7.92992E−02
A14 =			−1.90354E+00	3.34232E−02
	Surface #			
	6	7	8	9
k =	−3.71259E−01	−3.08415E+00	−5.52846E−01	−7.02751E+00
A4 =	1.70192E−01	−2.09220E−01	−1.81619E−01	−1.03346E−01
A6 =	1.15566E−01	1.92173E−01	7.68327E−02	4.58082E−02
A8 =	2.17515E−01	1.12763E−01	−1.95478E−02	−2.06972E−02
A10 =	−1.78345E−01	−7.71113E−02	−9.07977E−04	5.21553E−03
A12 =	1.94920E−02	−3.94624E−03	1.63783E−03	−6.30917E−04
A14 =			−3.51978E−04	−8.04728E−06

In Table 1, the curvature radius, the thickness and the focal length are shown in millimeters (mm). Surface numbers 0-12 represent the surfaces sequentially arranged from the object-side to the image-side along the optical axis. In Table 2, k represents the conic coefficient of the equation of the aspheric surface profiles. A1-A14 represent the aspheric coefficients ranging from the 1st order to the 14th order. This information related to Table 1 and Table 2 applies also to the Tables for the remaining embodiments, and thus an explanation in this regard will not be provided again.

FIG. **3** is a schematic view of an optical image lens assembly according to the second embodiment of the present disclosure. FIG. **4** shows spherical aberration curves, astigmatic field curves and a distortion curve of the optical image lens assembly according to the second embodiment. In FIG. **3**, the optical image lens assembly includes, in order from an object side to an image side, an aperture stop **200**, the first lens element **210**, the second lens element **220**, the third lens element **230**, the fourth lens element **240**, an IR (infrared) cut filter **260** and an image plane **250**.

The first lens element **210** is made of plastic material. The first lens element **210** with positive refractive power has a convex object-side surface **211** and a concave image-side surface **212**. The object-side surface **211** and the image-side surface **212** of the first lens element **210** are aspheric.

The second lens element **220** is made of plastic material. The second lens element **220** with negative refractive power has a convex object-side surface **221** and a concave image-side surface **222**. The object-side surface **221** and the image-side surface **222** of the second lens element **220** are aspheric.

The third lens element **230** is made of plastic material. The third lens element **230** with positive refractive power has a concave object-side surface **231** and a convex image-side surface **232**. The object-side surface **231** and the image-side surface **232** of the third lens element **230** are aspheric.

The fourth lens element **240** is made of plastic material. The fourth lens element **240** with negative refractive has a convex object-side surface **241** and a concave image-side surface **242**. The object-side surface **241** and the image-side surface **242** of the fourth lens element **240** are aspheric. The fourth lens element **240** has inflection points formed on the object-side surface **241** and the image-side surface **242** thereof.

The IR cut filter **260** is made of glass and located between the fourth lens element **240** and the image plane **250**, and will not affect the focal length of the optical image lens assembly.

The detailed optical data of the second embodiment are shown in Table 3 and the aspheric surface data are shown in Table 4 below.

TABLE 3

2nd Embodiment f = 2.97 mm, Fno = 2.60, HFOV = 36.8 deg.							
Surface #		Curvature Radius	Thickness	Material	Index	Abbe #	Focal length
0	Object	Plano	Infinity				
1	Ape. Stop	Plano	−0.116				
2	Lens 1	1.242830 (ASP)	0.339	Plastic	1.544	55.9	3.60
3		3.073100 (ASP)	0.404				
4	Lens 2	4.262600 (ASP)	0.234	Plastic	1.544	55.9	−10.62
5		2.405560 (ASP)	0.394				
6	Lens 3	−2.567550 (ASP)	0.574	Plastic	1.530	55.8	1.13
7		−0.522300 (ASP)	0.040				
8	Lens 4	1.899700 (ASP)	0.241	Plastic	1.530	55.8	−1.18
9		0.449280 (ASP)	0.700				
10	IR-filter	Plano	0.300	Glass	1.516	64.1	—
11		Plano	0.441				
12	Image	Plano	—				

Note:
Reference wavelength (d-line) is 587.6 nm.

TABLE 4

Aspheric Coefficients				
	Surface #			
	2	3	4	5
k =	−4.64729E−01	−1.00000E+00	−1.00000E+00	−1.00000E+00
A4 =	2.46820E−02	−5.11805E−02	−4.18851E−01	−2.47124E−01
A6 =	−3.35304E−02	−1.23657E−01	−1.06690E−01	−7.20515E−02
A8 =	1.57375E−01	3.70396E−02	−2.38094E−01	5.74152E−02
A10 =	−4.52684E−01	−2.30579E−01	−3.20555E−01	−3.36773E−02
A12 =	−8.64164E−02	−7.48167E−01	6.41982E−01	−1.21590E−01
A14 =			1.51967E−01	5.28413E−01
	Surface #			
	6	7	8	9
k =	−8.75390E+00	−4.76257E+00	−5.21930E+00	−5.22747E+00
A4 =	1.28767E−01	−1.64920E−01	−2.67574E−01	−1.72407E−01
A6 =	−9.46741E−02	1.57713E−01	1.10601E−01	7.36460E−02
A8 =	1.19782E−01	7.06963E−02	−1.70623E−02	−2.64292E−02
A10 =	−2.12502E−01	−8.26830E−02	−1.17143E−03	4.80165E−03
A12 =	9.27289E−02	1.16225E−02	1.50185E−03	−3.15488E−04
A14 =			−3.83819E−04	−2.53003E−05

In the optical image lens assembly according to the second embodiment, the definitions of f, Fno, HFOV, V1, V2, V3, V4, T12, CT2, f1, f2, f3, TTL and ImgH are the same as those stated in the first embodiment with corresponding values for the second embodiment. Moreover, these parameters can be calculated from Tables 3 and 4 as the following values and satisfy the following relationships:

f (mm)	2.97	V1 + V2 + V3 + V4	223.4
FNO	2.60	T12/CT2	1.73
HFOV (deg.)	36.8	f/f1	0.82
V2	55.9	|f/f2|	0.28
V1/V2	1.00	f/f3	2.63
V2/V3	1.00	TTL/ImgH	1.62
V3/V4	1.00		

FIG. **5** is a schematic view of an optical image lens assembly according to the third embodiment of the present disclosure. FIG. **6** shows spherical aberration curves, astigmatic field curves and a distortion curve of the optical image lens assembly according to the third embodiment. In FIG. **5**, the optical image lens assembly includes, in order from an object side to an image side, the first lens element **310**, an aperture stop **300**, the second lens element **320**, the third lens element **330**, the fourth lens element **340**, an IR (infrared) cut filter **360** and an image plane **350**.

The first lens element **310** is made of plastic material. The first lens element **310** with positive refractive power has a convex object-side surface **311** and a concave image-side surface **312**. The object-side surface **311** and the image-side surface **312** of the first lens element **310** are aspheric.

The second lens element **320** is made of plastic material. The second lens element **320** with negative refractive power has a concave object-side surface **321** and a concave image-side surface **322**. The object-side surface **321** and the image-side surface **322** of the second lens element **320** are aspheric.

The third lens element **330** is made of plastic material. The third lens element **330** with positive refractive power has a concave object-side surface **331** and a convex image-side surface **332**. The object-side surface **331** and the image-side surface **332** of the third lens element **330** are aspheric.

The fourth lens element **340** is made of plastic material. The fourth lens element **340** with negative refractive power has a convex object-side surface **341** and a concave image-side surface **342**. The object-side surface **341** and the image-side surface **342** of the fourth lens element **340** are aspheric. The fourth lens element **340** has inflection points formed on the object-side surface **341** and the image-side surface **342** thereof.

The IR cut filter **360** is made of glass and located between the fourth lens element **340** and the image plane **350**, and will not affect the focal length of the optical image lens assembly.

The detailed optical data of the third embodiment are shown in Table 5 and the aspheric surface data are shown in Table 6 below.

TABLE 5

3rd Embodiment f = 2.76 mm, Fno = 2.55, HFOV = 38.7 deg.							
Surface #		Curvature Radius	Thickness	Material	Index	Abbe #	Focal length
0	Object	Plano	Infinity				
1	Lens 1	1.567930 (ASP)	0.373	Plastic	1.544	55.9	3.70
2		6.515300 (ASP)	0.056				
3	Ape. Stop	Plano	0.354				
4	Lens 2	−11.428600 (ASP)	0.234	Plastic	1.544	55.9	−10.51

TABLE 5-continued

3rd Embodiment f = 2.76 mm, Fno = 2.55, HFOV = 38.7 deg.							
Surface #		Curvature Radius	Thickness	Material	Index	Abbe #	Focal length
5		11.525600 (ASP)	0.375				
6	Lens 3	−2.532820 (ASP)	0.607	Plastic	1.530	55.8	1.24
7		−0.566580 (ASP)	0.040				
8	Lens 4	1.848200 (ASP)	0.308	Plastic	1.530	55.8	−1.39
9		0.496120 (ASP)	0.700				
10	IR-filter	Plano	0.300	Glass	1.516	64.1	—
11		Plano	0.404				
12	Image	Plano	—				

Note:
Reference wavelength (d-line) is 587.6 nm

TABLE 6

Aspheric Coefficients				
	Surface #			
	1	2	4	5
k =	−7.63492E−01	−1.46434E+00	−3.00000E+01	5.00000E+00
A4 =	7.98798E−03	−7.59297E−02	−3.86819E−01	−2.33277E−01
A6 =	−7.55745E−02	−1.26615E−01	−1.35412E−01	−1.02237E−01
A8 =	1.05777E−01	−2.20569E−01	−2.73986E−01	−4.53402E−02
A10 =	−3.58552E−01	4.32973E−01	−4.50391E−01	−1.38267E−01
A12 =	−5.77891E−02	−7.48725E−01	8.36949E−01	−1.49347E−01
A14 =			1.29286E+00	6.81750E−01
	Surface #			
	6	7	8	9
k =	−3.80194E+00	−4.03643E+00	−5.18599E+00	−4.71487E+00
A4 =	8.26389E−02	−2.31093E−01	−2.44111E−01	−1.50243E−01
A6 =	−1.16087E−01	1.49539E−01	1.13701E−01	7.02280E−02
A8 =	1.20089E−01	7.36144E−02	−1.80531E−02	−2.69466E−02
A10 =	−2.21386E−01	−7.91198E−02	−2.09897E−03	5.50466E−03
A12 =	7.17039E−02	1.38314E−02	1.37244E−03	−2.57080E−04
A14 =	−6.45809E−03	7.11293E−05	−2.67698E−04	−5.75418E−05

In the optical image lens assembly according to the third embodiment, the definitions of f, Fno, HFOV, V1, V2, V3, V4, T12, CT2, f1, f2, f3, TTL and ImgH are the same as those stated in the first embodiment with corresponding values for the third embodiment. Moreover, these parameters can be calculated from Tables 5 and 6 as the following values and satisfy the following relationships:

f (mm)	2.76	V1 + V2 + V3 + V4	223.4
FNO	2.55	T12/CT2	1.75
HFOV (deg.)	38.7	f/f1	0.75
V2	55.9	|f/f2|	0.26
V1/V2	1.00	f/f3	2.22
V2/V3	1.00	TTL/ImgH	1.66
V3/V4	1.00		

FIG. **7** is a schematic view of an optical image lens assembly according to the fourth embodiment of the present disclosure. FIG. **8** shows spherical aberration curves, astigmatic field curves and a distortion curve of the optical image lens assembly according to the fourth embodiment. In FIG. **7**, the optical image lens assembly includes, in order from an object side to an image side, the first lens element **410**, an aperture stop **400**, the second lens element **420**, the third lens element **430**, the fourth lens element **440**, an IR (infrared) cut filter **460** and an image plane **450**.

The first lens element **410** is made of plastic material. The first lens element **410** with positive refractive power has a convex object-side surface **411** and a convex image-side surface **412**. The object-side surface **411** and the image-side surface **412** of the first lens element **410** are aspheric.

The second lens element **420** is made of plastic material. The second lens element **420** with negative refractive power has a convex object-side surface **421** and a concave image-side surface **422**. The object-side surface **421** and the image-side surface **422** of the second lens element **420** are aspheric.

The third lens element **430** is made of plastic material. The third lens element **430** with positive refractive power has a concave object-side surface **431** and a convex image-side surface **432**. The object-side surface **431** and the image-side surface **432** of the third lens element **430** are aspheric.

The fourth lens element **440** is made of plastic material. The fourth lens element **440** with negative refractive power has a convex object-side surface **441** and a concave image-side surface **442**. The object-side surface **441** and the image-side surface **442** of the fourth lens element **440** are aspheric. The fourth lens element **440** has inflection points formed on the object-side surface **441** and the image-side surface **442** thereof.

The IR cut filter **460** is made of glass and located between the fourth lens element **440** and the image plane **450**, and will not affect the focal length of the optical image lens assembly.

The detailed optical data of the fourth embodiment are shown in Table 7 and the aspheric surface data are shown in Table 8 below.

TABLE 7

(Embodiment 4) f = 2.93 mm, Fno = 2.40, HFOV = 37.1 deg.							
Surface #		Curvature Radius	Thickness	Material	Index	Abbe #	Focal length
0	Object	Plano	Infinity				
1	Lens 1	2.539590 (ASP)	0.530	Plastic	1.544	55.9	3.97
2		−13.469800 (ASP)	0.022				
3	Ape. Stop	Plano	0.354				
4	Lens 2	2.778210 (ASP)	0.262	Plastic	1.530	55.8	−12.48
5		1.892370 (ASP)	0.428				
6	Lens 3	−2.685670 (ASP)	0.625	Plastic	1.530	55.8	1.48
7		−0.657350 (ASP)	0.070				
8	Lens 4	1.663520 (ASP)	0.309	Plastic	1.530	55.8	−1.68
9		0.543090 (ASP)	0.700				
10	IR-filter	Plano	0.300	Glass	1.516	64.1	—
11		Plano	0.416				
12	Image	Plano	—				

Note:
Reference wavelength (d-line) is 587.6 nm.

TABLE 8

Aspheric Coefficients				
	Surface #			
	1	2	4	5
k =	−4.80271E+00	−3.71459E+00	3.75685E+00	3.72465E−02
A4 =	−3.20907E−02	−1.67511E−01	−3.42877E−01	−2.01865E−01
A6 =	−8.61624E−02	3.98284E−02	−3.82477E−02	−1.02790E−01
A8 =	6.73102E−02	−1.65231E−01	6.45730E−03	1.11264E−01
A10 =	−1.39356E−01	3.07496E−01	4.12355E−01	7.99160E−02
A12 =	5.44924E−02	−2.11803E−01	−1.09434E−01	−2.09560E−01
A14 =			−9.71971E−02	1.49611E−01
	Surface #			
	6	7	8	9
k =	−1.36576E+01	−4.17314E+00	−6.87488E+00	−4.44098E+00
A4 =	7.98770E−02	−1.58522E−01	−2.30986E−01	−1.59404E−01
A6 =	−1.21614E−01	6.56962E−02	1.04081E−01	7.74470E−02
A8 =	1.55182E−01	9.04205E−02	−1.99279E−02	−2.88514E−02
A10 =	−1.74899E−01	−5.84104E−02	−6.68312E−04	5.15643E−03
A12 =	9.22729E−02	1.74592E−02	1.51344E−03	−1.08053E−04
A14 =	−4.60717E−02	−5.73781E−03	−3.32728E−04	−6.53602E−05

In the optical image lens assembly according to the fourth embodiment, the definitions of f, Fno, HFOV, V1, V2, V3, V4, T12, CT2, f1, f2, f3, TTL and ImgH are the same as those stated in the first embodiment with corresponding values for the fourth embodiment. Moreover, these parameters can be calculated from Tables 7 and 8 as the following values and satisfy the following relationships:

f (mm)	2.93	V1 + V2 + V3 + V4	223.3
FNO	2.40	T12/CT2	1.44
HFOV (deg.)	37.1	f/f1	0.74
V2	55.8	|f/f2|	0.23
V1/V2	1.00	f/f3	1.97
V2/V3	1.00	TTL/ImgH	1.78
V3/V4	1.00		

FIG. **9** is a schematic view of an optical image lens assembly according to the fifth embodiment of the present disclosure. FIG. **10** shows spherical aberration curves, astigmatic field curves and a distortion curve of the optical image lens assembly according to the fifth embodiment. In FIG. **9**, the optical image lens assembly includes, in order from an object side to an image side, the first lens element **510**, an aperture stop **500**, the second lens element **520**, the third lens element **530**, the fourth lens element **540**, an IR (infrared) cut filter **560** and an image plane **550**.

The first lens element **510** is made of plastic material. The first lens element **510** with positive refractive power has a convex object-side surface **511** and a concave image-side surface **512**. The object-side surface **511** and the image-side surface **512** of the first lens element **510** are aspheric.

The second lens element **520** is made of plastic material. The second lens element **520** with negative refractive power has a convex object-side surface **521** and a concave image-side surface **522**. The object-side surface **521** and the image-side surface **522** of the second lens element **520** are aspheric.

The third lens element **530** is made of plastic material. The third lens element **530** with positive refractive power has a concave object-side surface **531** and a convex image-side surface **532**. The object-side surface **531** and the image-side surface **532** of the third lens element **530** are aspheric.

The fourth lens element **540** is made of plastic material. The fourth lens element **540** with negative refractive power has a concave object-side surface **541** and a concave image-side surface **542**. The object-side surface **541** and the image-side surface **542** of the fourth lens element **540** are aspheric. The fourth lens element **540** has inflection points formed on the object-side surface **541** and the image-side surface **542** thereof.

The IR cut filter **560** is made of glass and located between the fourth lens element **540** and the image plane **550**, and will not affect the focal length of the optical image lens assembly.

The detailed optical data of the fifth embodiment are shown in Table 9 and the aspheric surface data are shown in Table 10 below.

TABLE 9

5th Embodiment f = 2.94 mm, Fno = 2.60, HFOV = 36.8 deg.							
Surface #		Curvature Radius	Thickness	Material	Index	Abbe #	Focal length
0	Object	Plano	Infinity				
1	Lens 1	1.814880 (ASP)	0.374	Plastic	1.514	56.8	4.27
2		9.822600 (ASP)	0.054				
3	Ape. Stop	Plano	0.354				
4	Lens 2	2.306470 (ASP)	0.252	Plastic	1.535	56.3	−84.96
5		2.111460 (ASP)	0.506				
6	Lens 3	−5.105600 (ASP)	0.656	Plastic	1.535	56.3	1.31
7		−0.641690 (ASP)	0.050				
8	Lens 4	−29.231200 (ASP)	0.405	Plastic	1.544	55.9	−1.24
9		0.692940 (ASP)	0.700				
10	IR-filter	Plano	0.300	Glass	1.516	64.1	—
11		Plano	0.208				
12	Image	Plano	—				

Note:
Reference wavelength (d-line) is 587.6 nm.

TABLE 10

Aspheric Coefficients				
	Surface #			
	1	2	4	5
k =	−1.84691E+00	−3.00000E+01	4.33990E+00	3.41989E+00
A4 =	−3.01870E−02	−1.41764E−01	−2.84670E−01	−1.95930E−01
A6 =	−7.70714E−02	−4.73188E−02	−6.98347E−02	−1.59772E−01
A8 =	−1.11744E−02	−1.27282E−01	−1.94799E−01	−5.71142E−03
A10 =	−1.11484E−01	2.97856E−01	2.96525E−01	9.26092E−02
A12 =	1.68791E−02	−2.98320E−01	2.19620E−01	−1.36296E−01
A14 =			−9.69574E−02	1.78981E−01
	Surface #			
	6	7	8	9
k =	3.43575E−01	−3.82558E+00	−3.00000E+01	−6.55020E+00
A4 =	−3.33699E−02	−2.11042E−01	−2.13249E−01	−1.46807E−01
A6 =	−2.42609E−02	1.12918E−01	1.06353E−01	7.72890E−02
A8 =	1.62702E−01	8.68169E−02	−7.30569E−03	−3.20617E−02
A10 =	−2.31357E−01	−6.13312E−02	−2.99691E−03	6.59975E−03
A12 =	5.65353E−02	1.73963E−02	7.37853E−04	−3.12992E−04
A14 =	−6.27849E−03	−7.35468E−03	−4.46646E−04	−5.44347E−05

In the optical image lens assembly according to the fifth embodiment, the definitions of f, Fno, HFOV, V1, V2, V3, V4, T12, CT2, f1, f2, f3, TTL and ImgH are the same as those stated in the first embodiment with corresponding values for the fifth embodiment. Moreover, these parameters can be calculated from Tables 9 and 10 as the following values and satisfy the following relationships:

f (mm)	2.94	V1 + V2 + V3 + V4	225.3
FNO	2.60	T12/CT2	1.62
HFOV (deg.)	36.8	f/f1	0.69
V2	56.3	|f/f2|	0.04
V1/V2	1.01	f/f3	2.25
V2/V3	1.00	TTL/ImgH	1.71
V3/V4	1.01		

FIG. **11** is a schematic view of an optical image lens assembly according to the sixth embodiment of the present disclosure. FIG. **12** shows spherical aberration curves, astigmatic field curves and a distortion curve of the optical image lens assembly according to the sixth embodiment. In FIG. **11**, the optical image lens assembly includes, in order from an object side to an image side, the first lens element **610**, an aperture stop **600**, the second lens element **620**, the third lens element **630**, the fourth lens element **640**, an IR (infrared) cut filter **660** and an image plane **650**.

The first lens element **610** is made of plastic material. The first lens element **610** with positive refractive power has a convex object-side surface **611** and a concave image-side surface **612**. The object-side surface **611** and the image-side surface **612** of the first lens element **610** are aspheric.

The second lens element **620** is made of plastic material. The second lens element **620** with positive refractive power has a convex object-side surface **621** and a concave image-side surface **622**. The object-side surface **621** and the image-side surface **622** of the second lens element **620** are aspheric.

The third lens element **630** is made of plastic material. The third lens element **630** with positive refractive power has a convex object-side surface **631** and a convex image-side surface **632**. The object-side surface **631** and the image-side surface **632** of the third lens element **630** are aspheric.

The fourth lens element **640** is made of plastic material. The fourth lens element **640** with negative refractive power has a concave object-side surface **641** and a concave image-side surface **642**. The object-side surface **641** and the image-side surface **642** of the fourth lens element **640** are aspheric. The fourth lens element **640** has inflection points formed on the object-side surface **641** and the image-side surface **642** thereof.

The IR cut filter **660** is made of glass and located between the fourth lens element **640** and the image plane **650**, and will not affect the focal length of the optical image lens assembly.

The detailed optical data of the sixth embodiment are shown in Table 11 and the aspheric surface data are shown in Table 12 below.

TABLE 11

6th Embodiment f = 2.98 mm, Fno = 2.86, HFOV = 36.7 deg.							
Surface #		Curvature Radius	Thickness	Material	Index	Abbe #	Focal length
0	Object	Plano	Infinity				
1	Lens 1	1.914300 (ASP)	0.357	Plastic	1.514	56.8	4.60
2		9.439600 (ASP)	0.075				
3	Ape. Stop	Plano	0.354				
4	Lens 2	2.132520 (ASP)	0.252	Plastic	1.544	55.9	110.51
5		2.118860 (ASP)	0.601				
6	Lens 3	15.384600 (ASP)	0.769	Plastic	1.535	56.3	1.18
7		−0.645740 (ASP)	0.122				
8	Lens 4	−2.397820 (ASP)	0.243	Plastic	1.544	55.9	−1.02
9		0.745130 (ASP)	0.700				
10	IR-filter	Plano	0.300	Glass	1.516	64.1	—
11		Plano	0.088				
12	Image	Plano	—				

Note:
Reference wavelength (d-line) is 587.6 nm.

TABLE 12

Aspheric Coefficients				
	Surface #			
	1	2	4	5
k =	−2.21984E+00	−2.10306E+01	4.64291E+00	3.53430E+00
A4 =	−3.53189E−02	−1.41449E−01	−2.82662E−01	−1.97103E−01
A6 =	−7.65708E−02	−5.66540E−02	−3.45769E−02	−1.06744E−01
A8 =	−2.02192E−02	−9.72410E−02	−1.89225E−01	−1.05156E−02
A10 =	−7.83938E−02	3.27348E−01	1.42360E−01	7.56033E−02

TABLE 12-continued

Aspheric Coefficients				
A12 =	2.77381E−02	−3.25429E−01	−6.46968E−03	−1.39203E−01
A14 =			1.02628E−01	1.45291E−01
	Surface #			
	6	7	8	9
k =	−6.61041E+00	−4.20542E+00	−9.77940E−01	−8.60297E+00
A4 =	−7.76928E−02	−2.14311E−01	−2.19714E−01	−1.47805E−01
A6 =	−1.51394E−02	1.00177E−01	1.22943E−01	7.80997E−02
A8 =	1.71739E−01	8.17248E−02	−1.23235E−03	−3.14740E−02
A10 =	−2.07581E−01	−6.08849E−02	−2.73884E−03	6.45014E−03
A12 =	7.11239E−02	1.96020E−02	2.08879E−04	−3.38090E−04
A14 =	−2.81237E−03	−4.66134E−03	−7.99322E−04	−5.13843E−05

In the optical image lens assembly according to the sixth embodiment, the definitions of f, Fno, HFOV, V1, V2, V3, V4, T12, CT2, f1, f2, f3, TTL and ImgH are the same as those stated in the first embodiment with corresponding values for the sixth embodiment. Moreover, these parameters can be calculated from Tables 11 and 12 as the following values and satisfy the following relationships:

f (mm)	2.98	V1 + V2 + V3 + V4	224.9
FNO	2.86	T12/CT2	1.70
HFOV (deg.)	36.7	f/f1	0.65
V2	55.9	|f/f2|	0.03
V1/V2	1.02	f/f3	2.53
V2/V3	0.99	TTL/ImgH	1.71
V3/V4	1.01		

It will be apparent to those skilled in the art that various modifications and variations can be made to the structure of the present disclosure without departing from the scope or spirit of the disclosure. In view of the foregoing, it is intended that the present disclosure cover modifications and variations of this disclosure provided they fall within the scope of the following claims.

What is claimed is:

1. An optical image lens assembly comprising, in order from an object side to an image side:

a first lens element with positive refractive power having a convex object-side surface;

a second lens element with refractive power;

a third lens element with refractive power made of plastic material, wherein an object-side surface and an image-side surface of the third lens element are aspheric; and

a fourth lens element with negative refractive power made of plastic material, and having a concave image-side surface, wherein an object-side surface and the image-side surface of the fourth lens element are aspheric, and the fourth lens element has at least one inflection point formed on at least one of the object-side surface and the image-side surface thereof;

wherein the Abbe number of the first lens element is V1, the Abbe number of the second lens element is V2, the Abbe number of the third lens element is V3, the Abbe number of the fourth lens element is V4, a focal length of the optical image lens assembly is f, a focal length of the first lens element is f1, and the following relationships are satisfied:

$$0.8<V1/V2<1.3;$$

$$0.8<V2/V3<1.3;$$

$$0.8<V3/V4<1.3; \text{ and}$$

$$0<f/f1<1.2.$$

2. The optical image lens assembly of claim **1**, wherein the third lens element has positive refractive power.

3. The optical image lens assembly of claim **2**, wherein the third lens element has a concave object-side surface and a convex image-side surface.

4. The optical image lens assembly of claim **2**, wherein the focal length of the optical image lens assembly is f, a focal length of the second lens element is f2, and the following relationship is satisfied:

$$|f/f2|<0.5.$$

5. The optical image lens assembly of claim **2**, wherein the Abbe number of the second lens element is V2, and the following relationship is satisfied:

$$V2>50.$$

6. The optical image lens assembly of claim **1**, wherein a maximum image height of the optical image lens assembly is ImgH, an axial distance between the object-side surface of the first lens element and the image plane is TTL, and the following relationship is satisfied:

$$TTL/\mathrm{Img}H<2.0.$$

7. An optical image lens assembly comprising, in order from an object side to an image side:

a first lens element with positive refractive power having a convex object-side surface;

a second lens element with refractive power;

a third lens element with refractive power made of plastic material, wherein an object-side surface and an image-side surface of the third lens element are aspheric; and

a fourth lens element with negative refractive power made of plastic material, and having a concave image-side surface, wherein an object-side surface and the image-side surface of the fourth lens element are aspheric, and the fourth lens element has at least one inflection point formed on at least one of the object-side surface and the image-side surface thereof;

wherein the Abbe number of the first lens element is V1, the Abbe number of the second lens element is V2, the Abbe number of the third lens element is V3, the Abbe number of the fourth lens element is V4, an axial distance between the first lens element and the second lens element is T12, a central thickness of the second lens element is CT2, and the following relationships are satisfied:

$$0.8<V1/V2<1.3;$$

$$0.8<V2/V3<1.3;$$

$$0.8<V3/V4<1.3; \text{ and}$$

$$0.4<T12/CT2<2.5.$$

8. The optical image lens assembly of claim **7**, wherein the third lens element has a convex image-side surface.

9. The optical image lens assembly of claim **8**, wherein the second lens element has negative refractive power, and the third lens element has positive refractive power.

10. The optical image lens assembly of claim **9**, wherein a focal length of the optical image lens assembly is f, the focal length of the second lens element is f2, and the following relationship is satisfied:

$$|f/f2|<0.5.$$

11. The optical image lens assembly of claim **9**, wherein the axial distance between the first lens element and the second lens element is T12, the central thickness of the second lens element is CT2, and the following relationship is satisfied:

$$1.2<T12/CT2<2.5.$$

12. The optical image lens assembly of claim **7**, wherein the Abbe number of the first lens element is V1, the Abbe number of the second lens element is V2, the Abbe number of the third lens element is V3, the Abbe number of the fourth lens element is V4, and the following relationship is satisfied:

$$200<V1+V2+V3+V4<250.$$

13. An optical image lens assembly comprising, in order from an object side to an image side:

a first lens element with positive refractive power having a convex object-side surface and a concave image-side surface;

a second lens element with refractive power;

a third lens element with refractive power made of plastic material, wherein an object-side surface and an image-side surface of the third lens element are aspheric; and

a fourth lens element with negative refractive power made of plastic material, and having a concave image-side surface, wherein an object-side surface and the image-side surface of the fourth lens element are aspheric, and the fourth lens element has at least one inflection point formed on at least one of the object-side surface and the image-side surface thereof;

wherein the Abbe number of the first lens element is V1, the Abbe number of the second lens element is V2, the Abbe number of the third lens element is V3, the Abbe number of the fourth lens element is V4, and the following relationships are satisfied:

$$0.8<V1/V2<1.3;$$

$$0.8<V2/V3<1.3; \text{ and}$$

$$0.8<V3/V4<1.3.$$

14. The optical image lens assembly of claim **13**, wherein a focal length of the optical image lens assembly is f, a focal length of the third lens element is f3, and the following relationship is satisfied:

$$0.50<f/f3<3.00.$$

15. The optical image lens assembly of claim **14**, wherein the second lens element has negative refractive power, and the third lens element has positive refractive power.

16. The optical image lens assembly of claim **14**, wherein the focal length of the optical image lens assembly is f, a focal length of the second lens element is f2, and the following relationship is satisfied:

$$|f/f2|<0.5.$$

17. The optical image lens assembly of claim **14**, wherein the focal length of the optical image lens assembly is f, the focal length of the third lens element is f3, and the following relationship is satisfied:

$$1.00<f/f3<3.00.$$

18. An optical image lens assembly comprising, in order from an object side to an image side:

a first lens element with positive refractive power having a convex object-side surface;

a second lend element with refractive power;

a third lens element with refractive power made of plastic material, wherein an object-side surface and an image-side surface of the third lens element are aspheric; and

a fourth lens element with refractive power made of plastic material, and having a concave image-side surface, wherein an object-side surface and the image-side surface of the fourth lens element are aspheric, and the fourth lens element has at least one inflection point formed on at least one of the object-side surface and the image-side surface thereof;

wherein the Abbe number of the first lens element is V1, the Abbe number of the second lens element is V2, the Abbe number of the third lens element is V3, the Abbe number of the fourth lens element is V4, a focal length of the optical image lens assembly is f, a focal length of the third lens element is f3, and the following relationships are satisfied:

$$0.8<V1/V2<1.3;$$

$$200<V1+V2+V3+V4<250; \text{ and}$$

$$0.50<f/f3<3.00.$$

19. The optical image lens assembly of claim **18**, wherein the focal length of the optical image lens assembly is f, a focal length of the second lens element is f2, and the following relationships are satisfied:

$$|f/f2|<0.5.$$

20. The optical image lens assembly of claim **18**, wherein the focal length of the optical image lens assembly is f, a focal length of the first lens element is f1, and the following relationships are satisfied:

$$0<f/f1<1.2.$$

21. The optical image lens assembly of claim **18**, wherein the third lens element has positive refractive power and has a convex image-side surface.

22. The optical image lens assembly of claim **18**, wherein a maximum image height of the optical image lens assembly is ImgH, an axial distance between the object-side surface of the first lens element and the image plane is TTL, and the following relationship is satisfied:

$$TTL/\mathrm{Img}H<2.0.$$

* * * * *